Kelthane Residues on Almond Hull Meal Exposed to Ultraviolet Light Irradiation

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The effect of ultraviolet light radiation on such chlorinated hydrocarbon pesticides as p,p'-DDT, p,p'-DDD, p,p'-DDE, BHC, dieldrin, aldrin and endrin exposed either as thin films or in solutions has recently been reported (3,4,5,6,7). DDT and related chlorinated hydrocarbon residues on alfalfa hay exposed to drying by sunlight, ultraviolet light, and air has also been reported (1). Archer (2) has reported the effect of specific physical or chemical treatments on the residues of Kelthane on almond hull meal.

The present investigations were undertaken to study in the laboratory under controlled conditions the effect of a 157 hour ultraviolet exposure at 2537Å on the stability of Kelthane residues on almond hull meal.

Materials and Methods

Sample preparation, extraction and cleanup of the plant material, and the methods for the detection and determination of the pesticide have been described (2). The almond hull meal was spread in a 0.5 cm layer thickness in an aluminum foil lined carton, and exposed to ultraviolet lamp treatment at temperatures ranging from 36 to 47°C for 157 hours. The arrangement of the lamps was such

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to cover the plant samples to minimize ventilation and ambient drafts. Pesticide analyses were performed on the plant material and no attempt was made to recover very volatile reaction products since if they were present they would be in very low nondetectable quantities and interest was centered only on the products on the plant materials. The plant material was mixed twice daily to ensure uniform exposure to the light irradiation. The ultraviolet lamps contained two 15-watt, 25.56 -cm effective length, 2.54 -cm diameter General Electric germicidal lamps (G15T8) and were placed 5.08 cm above the plant material in such a manner as to equally illuminate the entire sample. Ultraviolet light intensity was measured with a Blak-Ray® Ultraviolet Intensity Meter (Ultra-Violet Products, Inc., Model J227 metering unit, J226 short wavelength cell) measuring microwatts per square centimeter, $\mu W/cm^2$, with an accuracy of ± 5% and converted to ergs per square centimeter intensity. Readings were made at a 5 -cm distance from the lamp at the surface of the treated sample.

Samplings of the exposed treated almond hull meal were as shown in Table 1. Moisture determinations and extractions for analyses were performed immediately after sampling, and the plant material was well mixed to prevent sampling errors, as well as to provide uniform exposure to the light sources. All residues are reported on a dry weight basis.

Results and Discussion

The major residues and reaction products on the almond hull meal irradiated with ultraviolet light are shown in Table 1. At zero time of exposure the plant material contained 10.2 ppm of Kelthane and no detectable 4,4'-dichlorobenzophenone.

The total residue expressed as Kelthane progressively decreased due to volatilization to a level of 5.2 ppm after 157 hours of u.v. irradiation which represented a 49% loss of the total residue.

Table 1

Levels[a] of Kelthane and 4,4'-dichlorobenzophenone on almond hull meal after exposure to ultraviolet[b] light

Exposure time (hours)	Kelthane ppm	Percent of total residue	4,4'-Dichloro-benzophenone ppm	Percent of total residue as Kelthane	Total residue as Kelthane ppm
0	10.2	100.0	ND[c]	0	10.2
11	8.1	89.0	0.67	11.0	9.1
35	6.4	75.2	1.4	24.8	8.5
59	4.0	69.0	1.2	31.0	5.8
85	4.4	72.0	1.1	28.0	6.1
157	3.4	65.3	1.2	34.7	5.2

[a] Original moisture 14%; no significant change during radiation; all results expressed on a dry weight basis.

[b] Ultraviolet light exposure (2537Å) at approximately 1.1×10^4 ergs/cm^2; average temperature of exposure 42°C.

[c] ND signifies nondetectable.

After 11 hours u.v. irradiation 11% of the total residue expressed as Kelthane was 4,4'-dichlorobenzophenone, and this compound increased to 31% after 59 hours irradiation and did not significantly increase after 157 hours of u.v. exposure.

The possibility of the presence of other decomposition products exists. However, due to the relative short treatment period and the type of "solvent" present (wax-like materials of the plant cuticle) the amounts of these products would be very small and probably nondetectable. Archer (2) has discussed the probability that Kelthane residues on almond hull mea_ are deposited in the wax-like materials of the plant cuticle. These materials could exert protective effects on Kelthane similar to those of benzeneazo-β-naphthol (3) on the photodecomposition of DDT.

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